THE ENERGY OBSERVER

Energy Efficiency Information for the Facility Manager

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Infrared Radiant Heating

The Energy Observer summarizes published material on proven energy technologies and practices, and encourages users to share experiences with generic energy products and services. This quarterly bulletin also identifies informational sources and energy training for facility managers and staff. ***The Energy Observer*** is a service of the **Energy Office, Michigan Department of Labor & Economic Growth.**

When constructing or renovating an area with high ceilings and potentially high infiltration, or in large spaces with spot heating needs such as warehouses, garages or enclosed storage spaces, there are several heating options to consider. The focus of this issue is Infrared Radiant Heating.

Energy savings of up to 50% are possible when converting a convective forced air heating system to Infrared Radiant (IR) heating. By heating the objects in the space vs. the air, IR heating is more efficient and can be more comfortable for the occupants.

How Does It Work

Infrared radiant heat is a form of electromagnetic energy (like light) that directly warms objects and people in its path, without heating the air in between. Radiant energy strikes the floor or objects and is converted into heat and absorbed into the floor or objects' surface. The floor than becomes a heat storage reservoir, re-radiating heat at the work level. This reduces the amount of heat that is wasted at the ceiling level.

Equipment Types

Three characteristics define IR heaters: fuel source, emitter type and ventilation. IR heaters can use electricity, natural gas, propane, or fuel oil to produce heat. In this publication, the focus will be on natural gas fired IR heating, as it is the most popular option for an energy saving retrofit.

Emitter types are categorized by the way the heat is emitted to the space. Emitters are either tube type or refractory materials. Tube type gas fired IR heaters are internally fired, with the radiating surface located between the hot gasses and the load. Combustion occurs inside the element, with temperatures reaching up to 1200°F.

Refractory materials consisting of ceramics, stainless steel, metallic screens, and glass wool are used in absorbing the heat from the combustion processes and distributing it evenly. IR heaters that utilize a refractory material may reach surface temperatures as high as 1800°F and are often times considered high-intensity heaters.

Ventilation is an important part of the combustion process. Tube type IR heaters generally vent to the outside where high intensity heaters often vent into the space being heated. Inadequate levels of combustion air for non-vented systems will likely decrease the indoor air quality.

Applications

IR heat is generally used in areas with high ceilings and potentially high infiltration or, in large spaces with spot heating needs such as warehouses, garages, enclosed storage spaces or gymnasiums.

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IR heating can be used as primary or supplemental heat. Depending on the type of space and the activity that takes place in a space, IR can be used in conjunction with conventional convection heating to provide solution to "cold spots" within that space. A cold spot may be near a door or window or other access to cooler areas. A small work area within a large space where the occupants remain stationary for long periods of time would be another ideal application for IR heating.

The ceiling height is a determining factor because most IR heaters require a minimum of 8 ft of clearance from objects that could be damaged by intense heat. A 12-foot ceiling minimum is recommended for IR heating.

The frequency of air changes in an area is another determining factor in evaluating IR heating. Areas with frequent air changes such as patios, open bay work areas or parking

areas can be quite costly to heat by convection. IR heating provides heat to the objects in the area and eliminates the need to re-heat all fresh air in the space. This results in lower heating costs, and improved comfort.

BENEFITS

Advantages

IR provides heat with lower air temperatures and comparable comfort to a convective system. This results in lower fuel consumption.

Zone control is possible with IR heating because not all areas require the same consistent temperature. Since IR heat is not dependent on heating masses of air, the system can be very flexible for providing only the required work surface temperature.

Additionally, fans and/or pumping are not required for heat distribution, resulting in additional energy reduction.

Disadvantages

Some occupants may experience discomfort due to warm heads and cold feet. This can be corrected by redirecting or re-positioning the heating units and reflectors.

All infrared radiant heaters have high surface temperatures therefore, should not be used when the atmosphere contains ignitable dust, gases, or vapors in hazardous concentrations. Also all combustible materials must be stored a suitable distance away from the heater, as specified by the manufacturer.

ECONOMICS

When evaluating a conversion to IR heating, the most influential factors will be the number of degree-days and the building volume. The length of the heating season and severity will dictate how quickly this type of project will pay itself off through energy savings. The size of the building is the second most important factor; there will be more opportunity to use IR systems in large spaces.

To determine the cost benefit of IR in your facility you will need to have a professional evaluate your specific space. Energy savings of 20-50% have been realized by converting from convective heating to IR heating. The average payback is approximately 2 years.

FOR MORE INFORMATION…

Rebuild America offers free tools and publications for evaluating building performance and equipment efficiency.
www.rebuild.org.
Publication: *National Best Practices Manual for Building High Performance Schools*

ASHRAE offers information about state-of-the-art HVAC&R technologies, publishes standards, and establishes guidelines.
www.ashrae.org Publication: *2004 HVAC Systems and Equipment Handbook*

SHARE EXPERIENCES…

Do you have an experience that you would like to share with readers on this topic or past topics of ***The Energy Observer****?*

WORKSHOP OPPORTUNITY

Advanced High Performance Building Workshop
August 24, 2004; Lansing, MI

more information/registration:
www.michigan.gov/eoworkshops

Visit the Energy Office website for information on current programs, services, past issues of ***The Energy Observer*** and grant information.
www.michigan.gov/energyoffice

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